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THE PRINCIPLES WHICH GOVERN OUR TREATMENT OF WOUNDS—A RESUMÉ OF OUR KNOWLEDGE UP TO THE PRESENT TIME.

BY AUGUSTUS C. BERNAYS, M. D.,
Prof. of Anatomy and Clinical Surgery, St. Louis College of Physicians and Surgeons.

Read before the St. Louis Academy of Medicine, Wednesday, April 2, 1890.

Reprint from the St. Louis *Clinique*, May, 1890.

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All surgeons know that their work is based upon a knowledge of the science, and practice of the art, of surgery. Rational treatment of wounds must be founded upon a scientific understanding of the pathological processes, which disturb natural repair and endanger the lives of the wounded by their extensive development. The principles as well as the methods which govern our management of wounds have undergone many changes. From time to time it is useful that an accounting be held so that we may clearly realize our position, first in regard to the principles, and secondly in regard to our practice. Papers which have aimed to fulfill this desideratum, appeared in large numbers in the beginning of the antiseptic era. More recently, since this era has gained full control, these essays have been more neglected. One paper, however, by Arthur Barth, has recently appeared, which brings our subject up to the very latest advancement, and in which the author in a masterly manner, goes over the entire field. I have been in the habit every winter in one or two lectures, of accounting to my hearers for my practice, entering fully into the reasons for my different acts which are necessary to perform in the treatment of wounds by the modern antiseptic methods.

The following pages will be a description of the views that have been gradually evolved by pathologists in regard to the etiology of infections of wounds and of their influence on our practical management. As my own views and experiences almost fully coincide with those of Dr. Barth, I shall endeavor to follow out his line of argument as nearly as possible. I am glad to do this because his paper, which appeared in Germany,* has as yet been entirely unnoticed in this country. Dr. Barth lays no claim to originality to any of the views, and, of course, I make no pretensions in that direction.

The recent great change of opinion which has taken place in regard to the principles of wound treatment, may be characterized by placing the

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* Deutsche Medecinische Wochenschrift, No. 7, 1890: Berlin.

aseptic principle in opposition to the antiseptic. In other words, the demand is made that the wound be kept aseptic, and that antisepsis be then relinquished. This naked proposition, although perfectly correct, is not as yet accepted by many. The idea, that if we keep the wound aseptic, antiseptics become superfluous, is undoubtedly correct. But if by asepsis, we mean a true condition of sterility, bacteriologically speaking, the fulfillment of the premise at the present time is an impossibility. We are unable, in our present state of knowledge, to sterilize wounds, and conscious of this weakness, many a firm believer in asepticism dusts the wound with iodoform or washes it with sublimate solution before closing it, and thus commits himself to antisepticism. This has been my experience, and although a confessed "Aseptic," a certain feeling of uncertainty has overcome me many times, and I have called for one of the antiseptic solutions which were at hand.

The changes which have taken place in wound treatment in the antiseptic era have been in accordance with the investigations and results of wound diseases. No method has received professional recognition on a large scale unless it has been scientifically tested by experiments, and its correctness microscopically established in the biological laboratory. Lister believed that the putrefaction of the wound secretions was the principal danger, and fully indorsed the theory of Pasteur that the decomposition and putrefaction of albuminous substances was due to micro-organisms. Pasteur's experiments proved that the germs in the dust suspended in the air were the cause of putrefaction, and this one-sided view completely controlled Lister, who at first fought only against the air germs, by attempting to keep these floating omnipresent germs away from the wounds. The spray was considered the important thing to keep away germs during the operation, and Lister's original wound dressing was intended to keep these dreaded germs away after the operation. In the beginning, Lister did not demand a disinfection of the wound itself, he feared the irritating qualities of the carbolic acid, and he held the opinion that nature would do the work of repair and healing, if only the chemical as well as the parasitical irritants were kept away.

Lister's prophylactic antisepticism was soon followed by the demand for an active disinfection of the infected tissues by his enthusiastic disciples. Discoveries in bacteriology helped this idea along, and we all remember the time when Billroth's coccobacteria septica were held to be responsible for the putrefaction of the wound secretions. Inflammation and suppuration, as well as other diseases of the wounds, were thought to be caused by the action of poisons resulting from putrefaction and von Bergmann and Schmiedeberg isolated a chemical substance called *sepsin* having the power of producing suppuration. But alongside of these doctrines the old ideas of chemical, thermic and mechanical irritants, as the etiological factors in producing inflammation, were still adhered to. It was only after Robert Koch by the discoveries laid down in his classical works, demonstrated the specific effects

of different kinds of bacteria beyond a possibility of error, that we began vaguely to surmise that every inflammation, every suppuration, yes, every kind of the so-called, '' accidental wound disease,'' were caused by different specific microbes. The consequence of this view necessarily was that prophylactic Listerian antisepsis was rapidly supplanted by an active antiparasitic therapy. If the antiseptic surgeons could make the floating atmospheric germs harmless, why could they not also kill the microbes which had developed in the tissues or in the wound? The indubitably brilliant effects of antiseptics in cases of phlegmonous or erysipelatous processes could be accounted for on this assumption. The consequence was that wounds were now flooded with poisonous solutions. We have all experienced a comfortable feeling of security when we treated infected angry wounds after free incisions, by pouring gallons of parasiticide liquids into the openings.

In the midst of this period of antiseptic enthusiasm, one fact, however, acted like a sedative, sobering down our ardor. There were the great laparotomists, Spencer-Wells, Keith, Koeberle, Tait and others, who, by the most painstaking cleanliness, without any antiseptics whatever, achieved the same good results as the strictest antisepticists. And what is more, their results were most brilliant, just where antiseptics had their weakest points, for instance in the prevention of septic peritonitis. The conclusion seemed inevitable that the human organism was fully capable to do away with a great part of the germs which enter into wounds, by its own unaided powers, and furthermore, it became very evident that the most dangerous germs were not those floating in the air.

Henceforth, a fundamental distinction was drawn between infection by contact and spontaneous infection. The former consists in the transfer of germs by means of instruments, sponges, dressings, and most frequently by the hands of the surgeon or assistants or nurses, who may be attending during an operation. It was soon clearly established that the most dangerous source of infection was connected with the fingers, clothing, etc., of the surgeons. It is evidently true that pathogenic germs, with which we constantly come in contact during the practice of our profession, may be directly carried from their source of growth to the wounds which we treat. Spontaneous infection, on the other hand, is caused by the germs of the air, which are not so virulent and need peculiar and uncommon conditions in order to live, such, for instance, as are found in the so-called dead spaces, cavities containing air which sometimes communicate with wounds. If we avoid these spaces by drainage or by packing with gauze, this spontaneous infection becomes impossible, and therefore, we give it no further elucidation.

As soon as the fact was established that wound diseases are caused by infection by contact, by inoculation as it were, the spray was abolished. Together with the mist of the spray, the mist of dark and confused notions also vanished. As soon as we placed the dangers of infection by contact squarely

before us, we tranferred the battlefield against our enemies, the germs, entirely away from the wound. We can now use the strongest poisons and most heroic measures on our instruments and hands, without the slightest danger to our patients. Here lies the important turning point in the history of antiseptics. The doctrine of infection by contact is the foundation upon which are based the principles of modern antiseptics.

The ways and means tc conclusively prove up this doctrine, in a scientific manner, were furnished by the method of making pure cultures of the different bacteria, which was taught by Koch. By his discoveries the life and habits of these disease germs were made clear to us. In rapid succession the microbes of the various wound diseases were made known. To be sure, all experiments were not successful, and the specific action of germs, as we know them, for instance, in erysipelas and gonorrhœa, were not proven in all cases. But still the presence of certain bacteria, in well-defined cases, was so regular and constant that their importance as the causes of disease could not be doubted. Thus, the fact was patent to all surgeons, that all kinds of suppuration are associated witn the presence of micro-organisms. The aims of antiparasitic wound treatment, have, by the recognition of this fact, been realized or rather advanced to a degree which surgeons have always tried to reach. The surgeon is held responsible not only for the occurrence of sepsis, but also for suppurations occurring ofter operations in aseptic tissues.

The next point was to establish the amount of execution which the different antiseptic chemicals could render in opposition to the germs. The final conclusion of many careful experimenters was, that we know no remedy which kills the germs instantly by mere contact, and that the antiseptic either does not surely and invariably kill the bacteria as we can employ it, or it seriously endangers the patient's life. Fortunately, however, for us, it is now admitted that the greatest good to be derived from antiseptics is done outside of and not within the wound. And here the work which has been done by bacteriologists has taught us the most valuable lessons. All that may be called sterilization is in the direction of the desired goal. We sterilize the field of operation, by scrubbing and shaving the skin, we remove the fat by ether or ammonia, and finally wash it carefully with corrosive sublimate. We sterilize the instruments by either placing them for twenty minutes or half an hour into five per cent carbolic acid, or by exposing them to the germ-killing effects of hot air or hot water. We sterilize our sponges by approved methods, or we use substitutes, such as gauze or cotton pledgets which have been sterilized. We use only sterilized drains and sutures, ligatures, dressings, etc. But first of all in importance, we have learned to sterilize our hands so thoroughly, that we can almost depend on their safety. The time is past where a hurried and careless dipping of the fingers into sublimate solutions is considered sufficient to appease the conscience of an antiseptic surgeon. All assistants and attendants must be reliably aseptic. Whoever does not accept

these propositions does not properly understand the modern spirit of antisepsis.

It is not my intention to enter upon the details of the rules and regulations which should govern modern hospitals, operating-rooms or sick chambers. These regulations are prophylactic and are directed against the development of the germs, or against their favorite haunts and abodes. Absolute cleanliness is the first and foremost demand. The walls must be smooth, corners should be avoided, the floors and ceilings so constructed that they can be washed, or douched, if necessary, with germ-killing solutions. We prefer to use glass for all vessels. Our instruments have been so changed that the rough, engraved handles are now replaced by smooth ones. Even the clothes we wear nowadays at operations are carefully selected, and are made of material that can easily be cleansed. Improvements are constantly being made in these measures of safety against germs.

It is evident from all this that we are gradually aiming to establish conditions of asepsis or sterility in all things which directly or indirectly come into use during a surgical procedure. We admit and believe that asepsis is preferable to antiseptics, but we must confess that we do not yet feel perfectly safe in discarding all antiseptics. This becomes apparent when just before closing a wound, the operator asks for iodoform or calls for sublimate solution. The fact is, we have seen splendid results from the antiseptic wound treatment, when carefully conducted, and cases of poisoning by carbolic acid, sublimate or iodoform, have been among the rarest accidents.

But it would not be just to accuse all antisepticists of acting on the sophism *post hoc ergo propter hoc*, because a wound does well under antiseptic treatment is no reason to claim that the treatment was the cause of the good result, we can only affirm that the organism of the patient, with our antiseptic assistance, successfully got away with all germs that may have been present. We can not prove that our antiseptic methods removed all germs.

The forces which the organism has at its disposal to combat the germs are still unknown; they have been called the "vital energy of the cells," but this is only a name which covers our imperfect knowledge. The researches of Grawitz have shown that all wound diseases are not due to specific energy of microbes. In some instances, the specific action has been demonstrated; for instance, in erysipelas, anthrax, gonorrhœa. But in many, the power of pus-producing microbes to create suppuration has conclusively been shown by Grawitz, to depend upon their becoming established in the tissues so that they can generate ptomaines. This demonstration by Grawitz has proven to most surgeons, that after all, one of the most important points in wound management is, that if we can not completely and infallibly keep germs out of our wounds, everything must be done to permit of the rapid absorption of the microbes by the blood, whence they can be harmlessly eliminated or made innocuous.

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